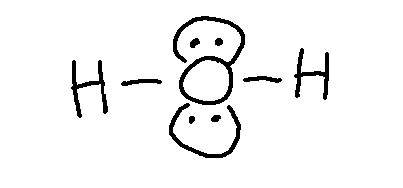
**2.3 – VSEPR Theory**

VSEPR – Valence Shell Electron Pair Repulsion 🡪 Often pronounced “vesspur”

**Main idea** – electron pairs repel each other whether they are in chemical bonds (bond pairs) or unshared (lone pairs). Electron pairs assume orientations about an atom that will then minimize this repulsion. Using this theory, we can then predict the shape of just about any molecule.



i.e. H2O

* Lone pairs have large repulsion - Lone pairs repulse bond pairs to
* Need to minimize make bent molecule.

Strongest repulsions: lone pair-lone pair > lone pair-bond pair > bond pair-bond pair

**Applying VSEPR Theory**

1. Draw a plausible Lewis structure of the molecule or polyatomic ion.
2. Determine the number of electron groups around the central atom, and identify them as being either bond electron groups or lone pairs of electrons.
3. Establish electron group geometry around the central atom – linear, trigonal-planar, tetrahedral, trigonal-bipyramidal, or octahedral. (Refer to chart below)
4. Determine the molecular geometry from the positions around the central atom occupied by the other atomic nuclei. (\*\*\*Therefore, the geometry when only taking into account atoms, and not electron pairs\*\*\*). Refer to table 11-1.

**Electron Group Geometries**

|  |  |
| --- | --- |
| **Number of electron groups** | **Geometry** |
| 2 | Linear |
| 3 | Trigonal-planar |
| 4 | Tetrahedral |
| 5 | Trigonal-bipyramidal |
| 6 | Octahedral |

**VSEPR Notation**

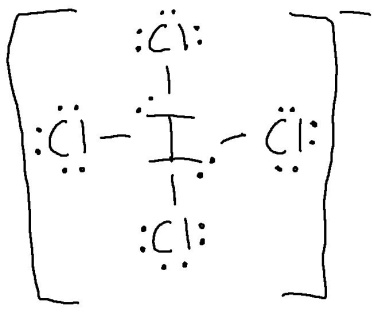
When determining the molecular geometry in step 4 above, we will write out the VSEPR notation from the information that we have obtained. This notation uses the following abbreviations:

A – Central Atom

X – Terminal Atom; groups of electrons bonded to A

E – Lone pairs of electrons around central atom

Let’s work through an example…

**ICl4-**

1. Number of valence electrons:

7 + (7 x 4) + 1 = 36

After drawing skeleton Lewis:

36 – 8 = 28 electrons to place.

1. Number of bond groups = 4

Number of lone pair groups = 2

1. 6 electron groups total 🡪 Octahedral
2. Molecular geometry 🡪 AX4E2

Refer to table 11.1 🡪 Square planar